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ANNUAL SOUTHWESTERN REGION
PEST CONDITIONS REPORT
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May 1986

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FOREWORD

Information on forest insect and disease conditions in the Southwest during 1985 was compiled with the assistance of the Forest Pest Management staff, Regional Office; Robert Celaya, Arizona Forestry Division; and Tony Smith, New Mexico Department of Agriculture.

Trade names and commercial enterprises or products are mentioned solely for necessary information. No endorsement by the U. S. Department of Agriculture is implied.

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INSECT AND DISEASE CONDITIONS

Conditions in Brief

Bark beetle-caused mortality of ponderosa pine decreased in the Southwest during 1985. Ips beetles continued to be the primary cause of mortality, followed by the western pine beetle and mountain pine beetle respectively. In mixed conifer forests, the fir engraver and Douglas-fir beetles caused the majority of tree mortality, especially in association with other pests such as root diseases and the western spruce budworm. Mortality of true firs and Douglas-fir increased slightly in 1985. Spruce beetle activity continued at outbreak levels in both Arizona and New Mexico. On the Fort Apache Indian Reservation, however, the spruce beetle infestation appears to be declining.

Total acreage of defoliation caused by western spruce budworm changed only slightly from 1984 to 1985. In northern New Mexico, extensive defoliation occurred on the Carson, Santa Fe, and Cibola National Forests and adjoining lands, including the Taos Pueblo Indian Reservation. Elsewhere, small, isolated pockets of defoliation occurred on the Lincoln and Gila National Forests in southern New Mexico. In Arizona, visible defoliation was detected on the Kaibab National Forest and adjoining Grand Canyon National Park. New areas of defoliation were also detected on the Apache-Sitgreaves National Forest. This is the first report of budworm defoliation on the Apache-Sitgreaves National Forest in recent times.

The amount of aspen defoliation in the Region decreased by about half from 1984 to 1985. In northern New Mexico, this damage was caused primarily by the large aspen tortrix and to a lesser degree by the western tent caterpillar. In Arizona, the western tent caterpillar was the primary cause of defoliation.

Defoliation of ponderosa pine by the pandora moth was not detected this year in the vicinity of Jacob Lake, Kaibab National Forest, Arizona, marking the end of an outbreak which occurred there from 1978 to 1983. However, a new area of defoliation was detected this year within the Grand Canyon National Park.

Southwestern dwarf mistletoe continued to be the most damaging disease of conifers. Its impact, particularly on growth and yield of ponderosa pine, was of major importance. Surveys were conducted on 71,075 acres of infected ponderosa pine stands, and survey data were used to assist in development of management alternatives. Dwarf mistletoe control projects were conducted on 8,660 acres of infected ponderosa pine stands.

Root and butt rots, principally Armillaria root rot and Fomes annosus root and butt rot, continued to cause tree mortality throughout the commercial timberlands of Arizona and New Mexico. Annual tree mortality due to Armillaria root rot is concentrated in commercial ponderosa pine stands, while annosus root rot mortality is concentrated in mixed conifer and spruce-fir stands.

Status of Major Insect Pests

Spruce beetle, Dendroctonus rufipennis.

Acres of spruce mortality caused by the spruce beetle totaled approximately 11,000 in 1985, an increase from levels reported in 1984. In Arizona, all mortality occurred on either the Fort Apache Indian Reservation or Apache-Sitgreaves National Forest. In New Mexico, most mortality occurred within or adjacent to the Pecos Wilderness, Santa Fe and Carson National Forests. Less extensive mortality was detected on the Valle Vidal Unit, Carson National Forest, and in wilderness areas on the Gila National Forest.

Survey results indicate that the spruce beetle outbreak on the Fort Apache Indian Reservation is in a declining trend, but still must be considered an epidemic situation. Tree losses in 1986 should be considerably less than in the peak outbreak years of 1981-83.

Mountain pine beetle, Dendroctonus ponderosae.

Ponderosa Pine mortality caused by this bark beetle increased slightly in 1985. In northern New Mexico, areas of concentrated mortality occurred on the Carson National Forest and Taos Pueblo Indian Reservation, while scattered mortality occurred on the Santa Fe National Forest. Scattered mortality also occurred on the Kaibab Plateau in northern Arizona on National Forest and Park Service lands.

Western pine beetle, Dendroctonus brevicomis.

Although populations are considered to be at endemic levels, this beetle continued to cause mortality of ponderosa pine throughout the Region. Mortality was typically scattered and limited to individual or small groups of trees at any given location. Other bark beetles such as the red turpentine beetle, Dendroctonus valens, are often involved in this mortality. Stress, as might result from disease, fire damage, drought, or aging evidently predisposes trees to beetle attack in many cases.

Pine engraver beetles, Ips spp.

Overall, Ips-caused pine mortality decreased in 1985. On the San Carlos Indian Reservation in Arizona, mortality decreased to negligible levels. Significant decreases also occurred on the Fort Apache Indian Reservation and the Apache-Sitgreaves National Forests. An exception to the general trend occurred on the Coconino National Forest, which had several areas of extensive ponderosa pine mortality due to Ips beetles.

Western spruce budworm, Choristoneura occidentalis.

Defoliation of Douglas-fir, true firs, and spruce caused by the western spruce budworm occurred on 632,124 acres in 1985, a slight decrease from the 692,100 acres reported in 1984. Acres of defoliation are summarized in table 1 by intensity and land ownership. Figure 1 illustrates where defoliation occurred within the Region. Defoliation remained widespread

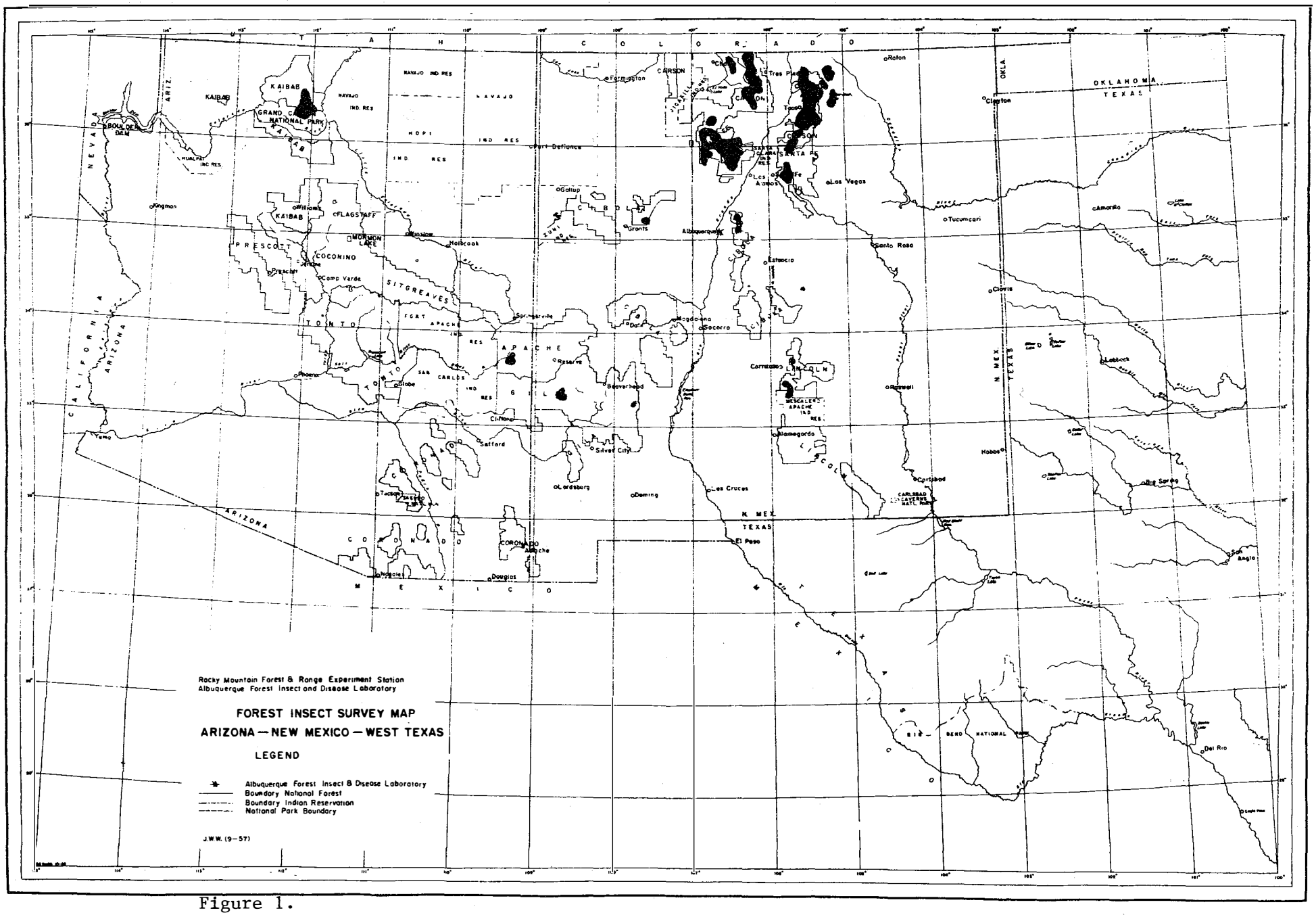

Figure 1.
Areas defoliated by the western spruce budworm, Region 3, 1985.

in northern New Mexico on the Carson, Santa Fe, and Cibola National Forests. In southern New Mexico, defoliation on the Lincoln National Forest and Mescalero Apache Indian Reservation decreased substantially, possibly due in part to a suppression project conducted there in 1984. Small pockets of defoliation were detected on the Gila National Forest. In Arizona, there was an increase in the number of acres defoliated on the Kaibab Plateau and new areas of defoliation were detected on the Apache-Sitgreaves National Forest.

Table 1. Acres of western spruce budworm defoliation, Region 3, 1985

Land Ownership	Relative defoliation intensity			
	Light	Moderate	Heavy	Total
National Forest	196,882	207,331	64,909	469,122
Indian	19,901	7,853	243	27,997
National Park Service	5,460	52,008	--	57,468
State and Private[1]	50,745	13,939	12,853	77,537

[1]Including lands surveyed by New Mexico Department of Agriculture personnel.

Egg mass surveys conducted on six National Forests and adjacent lands indicate that budworm-caused defoliation will occur again in 1986 in most of the areas where it occurred in 1985. Local fluctuations will occur, but the amount of defoliation region-wide is not likely to change to any great degree. On the Questa and Taos Ranger Districts, Carson National Forest, budworm populations are declining. On the eastern half of the Santa Fe National Forest, populations are generally increasing and the area of defoliation will probably be greater in 1986.

Pandora moth, Coloradia pandora.

No visible defoliation of ponderosa pine was detected on the Kaibab Ranger District in 1985 indicating that the outbreak there has ended. A new area of defoliation totaling approximately 760 acres has appeared in the Grand Canyon National Park near Cape Royale on the North Rim. Most likely, defoliation will be visible there again in 1978.

Aspen defoliators: large aspen tortrix, Choristoneura conflictana, and western tent caterpillar, Malacosoma californicum.

In New Mexico, defoliation caused by the large aspen tortrix and the western tent caterpillar was less extensive on the Carson and Santa Fe National Forests, and decreased to undetectable levels on the Lincoln National Forest. In Arizona, defoliation caused by the western tent caterpillar decreased on the Coconino National Forest and was at low levels or absent in other areas. Approximately 13,560 acres were defoliated by these insects in the Region during 1985.

Status of Other Insects

Common name	Scientific name	Host	Locality	Remarks
Cedar Bark Beetles	*Phloeosinus* spp.	Arizona cypress	Coronado NF, AZ	Limited Tree mortality
Twig Moths	*Dioryctria* spp.	Ponderosa pine	Apache-Sitgreaves NFs, AZ	Damage to plantation seedlings
Tip and shoot moths	*Rhyacionia* spp.	Ponderosa pine	Apache-Sitgreaves NFs, AZ	Sapling damage
Sawflies	*Neodiprion* and *Zadiprion* spp.	Ponderosa and pinyon pines	Navajo IR, AZ Cibola NF, NM	Isolated infestations
Silverspotted Tiger moth	*Halisidota argentata subalpina*	Pinyon pine and juniper	Florida Mountains BLM, NM	Population declining due to natural factors
Scale Insects	*Matsucoccus* spp.	Ponderosa pine	Apache-Sitgreaves and Kaibab NFs, AZ	Severe in localized areas
Giant Conifer Aphids	*Cinara* spp.	Ponderosa and pinyon pines	Cibola NF, NM Coconino NF, AZ Capulin Mountain National Monument, NM	Isolated infestations

Status of Pest Complexes

Widely scattered tree mortality and growth loss, due to a complex of forest insect and disease pests, occurs annually throughout the coniferous forests of the Southwest. Mortality is often a direct result of bark beetle attack, but a variety of factors may serve to weaken trees such as drought, stand stagnation, defoliation, fire, root disease, dwarf mistletoe, or poor site conditions. Any number or combination of these factors may act together. A couple of pest complexes that appear to be important in the Southwest are as follows.

Douglas-fir mortality. The amount of aerially detected mortality changed little from 1984 to 1985 in the Region. Pests which are frequently involved in this mortality include the Douglas-fir beetle, Dendroctonus pseudotsugae, root diseases, and Douglas-fir dwarf mistletoe, Arceuthobium douglasii. On the Carson National Forest and the Taos Pueblo Indian Reservation tree mortality was heaviest in areas defoliated by the western spruce budworm.

True fir mortality. Fir mortality was scattered throughout the mixed conifer forests of the Region, generally occurring in small groups of 1 to 10 trees. Highest concentrations of mortality were detected on the Carson and Santa Fe National Forests in New Mexico and the Coconino National Forest in Arizona, often in wilderness or other areas not managed for timber. Root diseases are commonly associated with this mortality and may predispose the trees to bark beetle attack. The fir engraver beetle, Scolytus ventralis, is the bark beetle usually found attacking white fir, while the western balsam bark beetle, Dryocetes confusus, is more common in subalpine or corkbark fir.

Other, less understood or documented, pest complexes also exist in the Southwest's forests. In general, forest managers should be aware that tree mortality and growth loss are quite often the result of more than just one biotic or abiotic factor. Pest management strategies which take into account the ecological complexity of pest problems will produce longer lasting results.

Status of Diseases

Dwarf mistletoes, Arceuthobium spp. (A. vaginatum subsp. cryptopodum --ponderosa pine; A. douglasii--Douglas-fir; A. microcorpum--spruce), cause significant losses in growth and yield on forest lands throughout the Southwest. Over 2.2 million acres of commercial forest land are currently infected. An estimated growth loss of 100 to 150 million board feet is caused by mistletoes each year in Arizona and New Mexico. Ponderosa pine dwarf mistletoe is the most widespread and damaging of these pathogens and is responsible for the greatest losses.

Presuppression surveys were conducted this past year on 71,075 acres of infected ponderosa pine stands on 10 Ranger Districts over 6 National Forests. Survey data provided an accurate accounting of mistletoe incidence and distribution in the heavily infected stands. Silvicultural prescriptions were written for each of the stands based on stand examinations, survey information, and stand diagnoses. RMYLD2, a growth

and yield simulation model, was used to refine the prescriptions and aided in the selection of the most appropriate silvicultural alternative for each stand.

The Region-wide mistletoe survey continued in 1985; distribution intensity, and volume losses associated with dwarf mistletoes were determined for the Santa Fe and Lincoln National Forests, New Mexico. A total of 7,341 acres were surveyed. Analyses were completed for surveys conducted on the Santa Fe and Lincoln National Forests, and final reports will be available in 1986. The survey will continue in 1986 on the Carson and Cibola National Forests, New Mexico. Results from the five completed surveys indicate that dwarf mistletoe incidence is increasing in the Region and infestations are intensifying in stands. On the Lincoln National Forest, mistletoe incidence in the ponderosa pine timber type has increased from 64 to 70 percent. On the Santa Fe National Forest, mistletoe incidence in ponderosa pine is 35 percent on commercial areas. The forest-wide incidence, however, is probably higher since non-commercial acres are heavily infected. Conservative estimates of annual board-foot volume losses in millions of board feet (MMBF) for the Forests are: 6 to 9 for the Lincoln, and 14 to 21 for the Santa Fe. Mistletoe incidence and associated volume losses in the Douglas-fir, white fir, and spruce-fir timber types will be forthcoming when subroutines dealing with these species are available through RMYLD.

Root diseases were responsible for an approximate 10 percent reduction in growth and yield Region-wide. Estimates range as high as 25 percent in some seriously infected stands. Armillaria mellea accounts for most of the damage and volume loss in conifers, especially ponderosa pine; other root pathogens, including Fomes annosus, Phaeolus schweinitzii, and Inonotus tomentosus, are responsible for the remaining loss. At least 15 to 20 MMBF are lost annually to root rot mortality in the Southwest, and estimates run as high as 45 MMBF, including growth losses.

The effectiveness of seedbed fumigation with methyl bromide and chloropicrin was evaluated at the Albuquerque Tree Nursery. Pre-and post-fumigation surveys indicated that fumigation effectively reduced the levels of Fusarium spp. in the soil, resulting in increased seedling survival. Fumigation was effective in reducing Fusarium propagule levels from 6,000 propagules per gram (ppg) to 27 ppg. Seedling densities were up to 100 percent greater in the fumigated versus unfumigated sections.

Aspen stands in Arizona and New Mexico are attacked by several pathogens which cause stem cankering, most notably: Ceratocystis fimbriata, Hypoxylon mammatum, Cenangium singulare (Encoelia pruinosa), Cytospora chrysosperma, and Cryptosphareria populina. Canker fungi cause significant reductions in growth and vigor in mature aspen stands, resulting in tree mortality from girdling cankers, top breakage, and cull and degrading. In many of the Region's aspen stands, 30 percent or more of the stems are affected. In addition to the damage and losses associated with stem cankering, the aspen timber type suffers widespread losses to stem decay caused by the false tinder fungus, Phellinus tremulae. White trunk rot incidence is especially significant in mature aspen stands, and cull volumes may range as high as 50 to 60 percent of

the total standing volume. As the aspen resource is developed in this Region, and aspen stands are more routinely subjected to timber management planning and commercial entries, it will be necessary to critically evaluate the impact of these diseases and develop management strategies for their control.

Mature and overmature true fir and spruce stands have a scattered incidence of Echinodontium tinctorium. While the pathogen is indigenous to these timber types, losses are considered insignificant. As the relative abundance of overmature and decadent stands decreases, so will the incidence of this pathogen. Similarly, Phellinus pini is endemic in mature and overmature ponderosa pine, true fir, Douglas-fir, and spruce stands. In the future, vigorously growing stands should be lightly impacted by either of these pathogens.

FOREST PEST CONDITIONS REPORTED BY THE STATE OF ARIZONA

by

Robert Celaya[1]

Prescott scale, Matsuccocus vexillorum, was identified infesting ponderosa pines in several areas of the state in 1985. The first site was in Prescott followed by the Payson, Clints Well, Overgaard and Lakeside-Pinetop areas. The principal damage caused by this insect is twig killing or "flagging" of branches which results in a weakening of both young and mature ponderosa pines. The flagging, referred to as twig blight, was first noted in Prescott in 1918. It was not properly identified until 1934-35, when an extensive study was completed. Outbreaks of these insects usually last about two years and the outbreak noted in 1985 is expected to decline in 1986.

Comandra blister rust, Cronartium comandrae. This rust was detected on Eldarica pine, Pinus eldarica, in Geronimo Estates north of Payson in 1985. This is the third major location for this rust on this imported pine. It was first detected in the Prescott area in 1983 and in Sedona in 1984. It appears to be found almost exclusively in areas where oak is present. Bastard toadflax, the alternate host for the rust is a partial root parasite of oak. Based on this observation, Eldarica pine should not be planted wherever oak is found. Another interesting observation relative to this rust is its absence on native ponderosa pines. The only infested ponderosa pines detected in 1985 were seedlings imported into the state. Native ponderosa pines apparently have a high resistance to the disease. The rust was also detected in Prescott Valley and Prescott Country Club on Eldarica pine in 1985.

Pine tip moths, Rhyacionia spp. These insects are usually a problem at the higher elevations on ponderosa pines. However, heavy infestations of tip moths were detected on Eldarica pine Christmas tree plantations near the lower elevation communities of Benson and Camp Verde, Arizona. The plantation in Benson was treated with insecticides to reduce the damage caused by the insect. The species and life cycle of the tip

[1]Forest Entomologist with the Division of Forestry, Arizona State Land Department

moth(s) may have to be determined in order to effectively treat the plantations. Shearing of the trees prior to Christmas may also help to reduce the unsightly affect of the pest. Additional surveys of other plantings for this pest are planned for 1986.

Texas root rot, Phymatotrichum ommivorum. This disease was identified infecting an eldarica pine Christmas tree plantation near Benson, Arizona. Pine trees are normally resistant to this disease, but these pines are planted in former cotton fields. Cotton is very susceptible to Texas root rot. Individual trees and groups of trees exhibited various stages of discoloration. Mortality was most pronounced at the center of the infection pocket. The infections are not considered serious in this large plantation, but smaller plantations may suffer unacceptable losses. Unfortunately, the majority of the Christmas tree plantations in Arizona are located in the southeast part of the state where Texas root rot is common. This is the second major disease noted on this exotic pine (see Comandra blister rust).

Urbanization stresses in forested areas continued to cause damage and mortality to trees in 1985. Late in 1984, members of the Pinetop-Lakeside City Council were informed about damage to forest trees due to construction. In February 1985, the newly incorporated community passed a tree protection/ removal ordinance. The ordinance is a good start and efforts will continue to implement it properly and to strengthen its provisions. Information on urbanization problems was also provided to the City of Prescott early in 1985. A tree protection/removal ordinance was proposed by the City but was opposed by local developers and realtors. Efforts to encourage Prescott to provide some type of tree protection will continue in 1986. The City of Flagstaff and Coconino County were also presented with information on urbanization problems. Efforts will also continue in 1986 to encourage these organizations to provide some type of tree protection.

FOREST PEST CONDITIONS REPORTED BY THE STATE OF NEW MEXICO

by

Tony Smith[2]

Western spruce budworm, Choristoneura occidentalis. Western spruce budworm increased in both intensity and area infested on State and private lands. Increases were seen on the Baca Location No. 1, the Philmont Scout Ranch, in the Moreno Valley, the Rio Costillo ski area, and on the Tierra Amarilla Grant. Egg mass surveys indicate that defoliation will be moderate to heavy in all areas with the greatest potential for increase and severe defoliation in the extensive host type near Chama and along the Rio Costillo.

During June a spruce budworm suppression project was conducted on 8,000 acres of private land at the southern end of the Moreno Valley. The insecticide used was the microbial agent Bacillus thuringiensis (B.t.). The oil-based Dipel 8L formulation at 32 ounces per acre was sprayed undiluted. Rotary atomizers were used and the dosage rate was 16

[2]Forest Entomologist with the New Mexico Department of Agriculture

B.I.U.'s per acre. The project marked the first such operational use of this dosage rate and application technique against a forest defoliator in the United States. Post-spray larval populations and egg mass densities were reduced to less than 1 per 100 buds and egg mass densities average 0.62 per square meter of foliage, as compared to an average of 14.7 masses per square meter of foliage in the check block.

Western tent caterpillar, Malacosoma californicum and the large aspen tortrix, Choristoneura conflictana. Defoliation caused by these insects remains at somewhat over 20,000 acres in northern New Mexico, with the bulk of it on the Baca Location No. 1 and the Tierra Amarilla Grant. Generally, the tent caterpillar infests aspen west of State Highway 84 and the tortrix predominates to the east on the Carson National Forest. Tent caterpillars near Chama showed significant infection by a nucleopolyhedrosis virus which is expected to have a great impact on the populations in 1986.

Douglas-fir tussock moth, Orgyia pseudotsugata. The chronic infestation of ornamental spruce, true firs, and Douglas-fir continued in Santa Fe for the 20th year. Trees sprayed with carbaryl for two or three consecutive years have done well, but resistance by many private property owners and groups to chemical treatment precludes a concerted city-wide suppression project. Tussock moth is also reported attacking ornamentals in Ruidoso.

Pinyon needle miner, Coleotechnites edulicola. Nearly 2000 acres of pinyon are infested northwest of Santa Fe, centered around the Las Tierras development resulting in moderate defoliation for the forth consecutive year. A massive outbreak of this insect covering in excess of 30,000 acres was detected along U. S. Route 285 between Ojo Caliente and Tres Piedras. Approximately 20,000 acres are on Forest Service land and the remainder occurs on private ownerships. Heavy to severe defoliation was detected on more than 6,000 acres. In 1986 the infestation is expected to increase in extent and severity.

An oak defoliator, family Tortricidae, species unknown. In 1983, over 44,000 acres of Gambel oak were nearly completely defoliated on the Tierra Amarilla Grant and the infestation declined to about 10,000 acres in 1984. This outbreak further declined to fewer than 300 acres in 1985 and is not expected to continue.

Gypsy moth, Lymantria dispar. The New Mexico Department of Agriculture has cooperated with APHIS for the past 9 years in placing pheromone traps in areas likely to become infested with this insect. All life stages may be transported by motor vehicles, but pupae and egg masses are the most common. In 1984, a single moth was caught in Roswell at an R.V. park, but in 1985 no moths were caught. Survey will continue in 1986.

Pinyon needle scale, Matsucoccus acalyptus. New infestations of this insect were detected near La Luz, Alamogordo, Carrizozo, and Questa. Some high value trees around home sites were sprayed with Cygon and good control was obtained. The ongoing infestation in the Capitan area

continues to cause heavy defoliation of pinyons in widely scattered spots throughout 100 square miles.

European elm scale, Gossyparia spuria. Most of the American elms in Albuquerque, Socorro, Santa Fe, Las Vegas, and Raton are heavily infested with this scale and some Lecanium sp. scales. These sucking insects can cause branch and limb mortality, creating ideal breeding habitat for Scolytus multistriatus, the smaller European bark beetle. This beetle is responsible for the spread of Dutch elm disease, but to date, the disease has not been detected in New Mexico.

Engraver beetles, Ips spp. Ips attacks were primarily confined to areas where new home construction is encroaching into pinyon-juniper woodlands, particularly near Santa Fe, Cedar Crest, Albuquerque and Ruidoso. Ips beetles also attacked ponderosa near Raton which were heavily infested with a needle cast disease (Lophodermella cerina) in 1983 and then severely damaged by red belt in 1984. The needle cast disease which affected more than 16,000 acres in 1983 has declined to fewer than 500 acres in 1985.

Twig beetle, Pityophorus spp. Ponderosa pines were attacked by these beetles over approximately 1,200 acres southwest of Grants. This is an increase from 1984 and the pole-sized trees now exhibit light to moderate branch flagging. The infestation apparently started in a thinned area and is expected to continue in 1986. No resultant tree mortality was noted.

Spruce beetle, Dendroctonus rufipennis. Seven small pockets of beetle activity totaling about 60 acres were noted in high elevation stands along the ridgeline east of Brazos Meadows on the Tierra Amarilla Grant. The vulnerable condition of the host type will probably lead to a spread of the infestation in 1986. However, most of the old-growth stands in the area were killed by this beetle in the early sixties.

Red Belt, a physiological condition of winter dehydration. Most trees in the 150,000 acres of coniferous forest showing this condition in 1984 along the east side of the Sangre de Cristo Range have recovered. Growth of Ponderosa pine, white pine, and Douglas-fir is good while the true firs are not progressing nearly as well. Some mortality of true firs was noted throughout the affected area, but no secondary insect outbreaks were detected.

FOREST PEST MANAGEMENT ACTIVITIES IN 1985

Major activities of the Southwestern Region Forest Pest Management (FPM) staff include detection, evaluation, and suppression of forest pests and technical assistance to forest land managers on all Federal lands in Arizona and New Mexico. In addition, FPM personnel cooperated with the States of Arizona and New Mexico in carrying out forest pest management activities on State and private lands through the Cooperative Forest Pest Action Program.

Detection Surveys

Detecting and monitoring insect and disease outbreaks and infestations is a major responsibility of the FPM staff. This is accomplished by systematic aerial surveys, ground examinations, and encouraging forest workers to report unusual and suspected insect and disease occurrences by means of field surveillance kits provided by FPM.

Aerial surveys were conducted from July through August over 8.5 million acres of coniferous forests in Arizona and New Mexico to determine the location and extent of damage caused by insects and/or diseases. Upon completion of the surveys, maps showing the location, relative intensity, and kinds of outbreaks were prepared and sent to the respective administrative units.

Ground examinations were made, when necessary, to confirm aerial detection observations, as well as in response to requests from land managers for detailed information or identification. State pest management specialists conducted ground surveys on State and private lands in Arizona and New Mexico.

A wide variety of insects and diseases were identified by the staff from surveillance reports sent by forest workers from across the Region. Such reports are important for the early detection of potential pest problems, and land managers and forest workers are encouraged to continue to be alert for, and prompt in, reporting any unusual insect and disease activity.

Evaluations

Another major responsibility of FPM is to evaluate forest pest problems and provide land managers with alternatives and recommendations for management through a variety of approaches. Twenty-three biological evaluations were conducted in 1985.

Entomology. The following new and continuing western spruce budworm evaluations were conducted:

(1) Sandia Peak Ski Area, Cibola National Forest, New Mexico; (2) Bear Wallow/Willow Creek area, Gila National Forest, New Mexico; (3) Lincoln National Forest and Mescalero Apache Indian Reservation, New Mexico; (4) Carson National Forest, New Mexico, including a separate evaluation of (5) the 1985 Suppression Project; (6) Santa Fe National Forest, Jemez Indian Pueblo, and Santa Clara Indian Pueblo, New Mexico; (7) Alpine District, Apache-Sitgreaves National Forest, Arizona.

Other biological evaluations dealt with bark beetles: (8) Spruce beetle population trends, and tree losses, Fort Apache Indian Reservation, Arizona; (9) Spruce windthrow, Canjilon District, Carson National Forest, New Mexico; (10) *Ips* beetles in thinning areas, Navajo and (11) Fort Apache Indian Reservations, Arizona; (12) ponderosa pine mortality, Alpine District, Apache-Sitgreaves National Forest, Arizona, and (13) Reserve District, Gila National Forest, New Mexico.

Pathology. Biological evaluations conducted in 1985 were of the following: (1) effectiveness of soil fumigation, with methyl - bromide and chloropicrin, in reducing populations of Phythium and Fusarium spp. in seedbeds at the Albuquerque Tree Nursery, Cibola National Forest, New Mexico; (2) Mint Springs Timber Sale, Mormon Lake District, Coconino National Forest, Arizona; (3) Turkey Pen plantation dwarf mistletoe project, Blue Ridge District, Coconino National Forest; (4) red belt damage in stands on the Las Vegas District, Santa Fe National Forest, and (5) on the Picuris and Santa Clara Pueblos, New Mexico; (6) compartment exams from dwarf-mistletoe infected stands for the Little George project, Springerville District, Apache-Sitgreaves National Forests, (7) the Abineau project, Elden District, Coconino National Forest, and (8) the Lamb's Lake project, North Kaibab District, Kaibab National Forest, Arizona; (9) compartment exams from the South Boundary project, Taos District, Carson National Forest, New Mexico; and (10) the Gentry and Summit Burn dwarf mistletoe suppression projects on the Pleasant Valley District, Tonto National Forest and Williams District, Kaibab National Forest respectively, Arizona.

Suppression Projects

Forest insect and disease pests occasionally increase to significant levels and cause unacceptable damages to forest resources. These pests must then be managed by employing a combination of silvicultural, mechanical, biological, and/or chemical suppression strategies.

In 1984, Forest Pest Management conducted or participated in the following suppression projects:

(1) Aerial and ground applications of the biological insecticide Bacillus thuringiensis to epidemic western spruce budworm populations on selected portions of the Carson National Forest and nearby private lands (10,352 hectares plus 11 campgrounds);

(2) thinning, pruning, chipping, and/or removing infested trees to control dwarf mistletoe infestations on a total of 8,660 acres of National Forest lands as listed in the following table.

Dwarf mistletoe presuppression surveys and suppression projects conducted during 1985 included:

National Forest	Ranger District	Acres	Survey	Suppression
Carson	El Rito	16,275	X	
	Taos	150		X
Santa Fe	Las Vegas	2,500	X	
	Jemez	7,500	X	
		1,000		X
	Coyote	9,500	X	
Gila	Silver City	200	X	
Kaibab	Williams	9,000	X	
	Tusayan	4,500	X	
	North Kaibab	4,500		X
Apache-Sitgreaves	Springerville	290		X
Coconino	Blue Ridge	7,500	X	
	Elden	2,900	X	
		2,720		X
Tonto	Payson	11,200	X	

RECENT PUBLICATIONS

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